

Preparatory Pathways and STEM Calculus Completion for Special Populations

Implications of the AB 1705 Standards

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California
Community
Colleges



Multiple Measures
Assessment Project

TheRPGroup

Introduction

[Assembly Bill \(AB\) 1705](#) seeks to improve California community college students' progress in Science, Technology, Engineering and Math (STEM) programs. The law ensures that students begin math in the course that best positions them to complete their calculus requirement. A college has this obligation to all STEM students, regardless of their background or special population status.

Previous research conducted by The RP Group's Multiple Measures Assessment Project (MMA P) and summarized in [Preparatory Pathways and STEM Calculus Completion: Implications of the AB 1705 Standards](#) found high rates of attrition along the path to calculus for students who began in preparatory courses. When grouped by level of high school math preparation, students who directly enrolled in STEM Calculus 1 were more likely to complete calculus within two years than those who started in preparatory coursework. This key finding was also true across placement levels defined by a combination of high school grade point average (HSGPA) and high school math preparation.

This brief provides additional analysis focusing on STEM students from special populations. Specifically, we examined STEM students who participated in one or more of the following programs while enrolled at a California community college: Disabled Students

Key Terms

STEM Calculus Pathway: A sequence of courses comprised of one or more transfer-level preparatory courses and STEM Calculus 1.

Direct Enrollment: Student's first math enrollment in the California Community Colleges (CCC), not necessarily in the freshman year.

STEM Calculus 1: The first STEM Calculus course, equivalent to C-ID Math 210, 211, or the first half of Math 900S.

Preparatory Course: A transfer-level math course required in the path to STEM Calculus 1 that may include College Algebra, Trigonometry, or Precalculus.

STEM Calculus 1 Two-Year Throughput: Proportion of the cohort starting in a specified course in the STEM Calculus Pathway (College Algebra, Trigonometry, Precalculus, or STEM Calculus 1) who successfully completed STEM Calculus 1 (with a C or better) within two years.

Programs and Services ([DSPS](#));¹ Extended Opportunity Programs and Services ([EOPS](#)); Mathematics, Engineering, and Science Achievement ([MESA](#)); [Puente](#); and/or [Umoja](#). It also includes students classified as [economically disadvantaged](#), [foster youth](#), and/or [military](#). We begin with an overview of the methodology, followed by key findings and conclusions.

Methodology

This analysis of STEM Calculus 1 completion for STEM students from special populations extends our original research and applies the same methodology used in the statewide analysis of all STEM majors.²

In summary, we obtained data from the California Partnership for Achieving Student Success (CalPASS), with technical assistance from Education Results Partnership (ERP), which managed the system. The CalPASS data system contained anonymous and encrypted student-level data from participating K–12 and postsecondary institutions, including data from the Chancellor’s Office Management Information System (COMIS) and the centralized California community college application, CCCApply.

We identified STEM students as those who had declared a STEM major and whose first math enrollment within the California Community Colleges (CCC) was a transfer-level preparatory course in the STEM calculus pathway or STEM Calculus 1. For this brief, we disaggregated the original cohort by special population variables reported by colleges through COMIS (see Appendix A). If students had a special population status at any point in the timeframe of the study, we included them in the analysis (see Table 1, Appendix B).

We grouped students using the STEM Calculus pathway placement profiles defined by the California Community Colleges Chancellor’s Office (CCCCO) in February 2024.³ Students with a higher placement profile have a HSGPA of 2.6 or greater and have passed high school Precalculus or Trigonometry with a grade of C or higher. The lower placement profile includes everyone else, specifically students who meet one or both of the following: (1) HSGPA of less than 2.6 and/or (2) have not passed high school Precalculus or Trigonometry.⁴

¹ For an analysis by disability type, see [Preparatory Pathways and STEM Calculus Completion for Students with Disabilities](#).

² Find full methodology in the [technical appendix](#) to the main report.

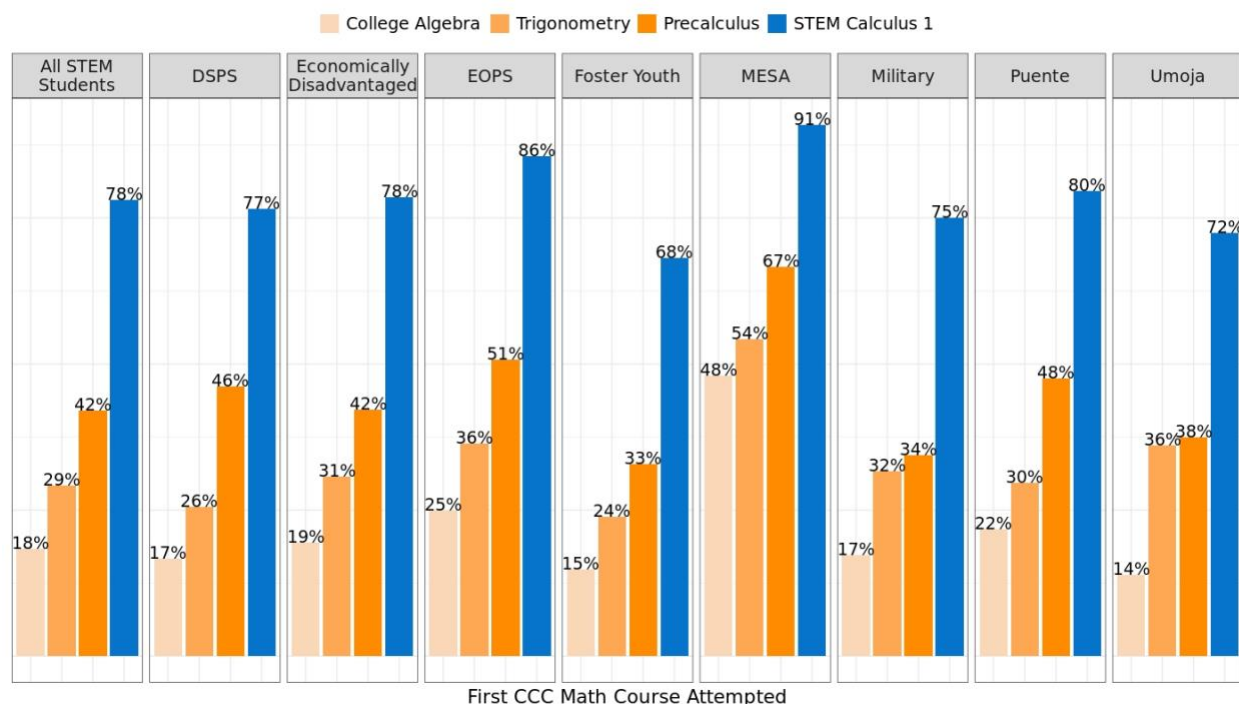
³ See the California Community Colleges Chancellor’s Office [memorandum](#).

⁴ These placement profiles were not used by colleges during the timeframe of this study. For an overview of math placement and calculus access policies across colleges, see Appendix I of the [main report](#).

Key Findings

For every special population examined, calculus completion was highest with direct enrollment into STEM Calculus 1 and progressively lower for students starting in Precalculus, Trigonometry, and College Algebra (Figure 1).

Figure 1. STEM Calculus 1 Two-Year Throughput for Special Populations by First CCC Math Course Attempted

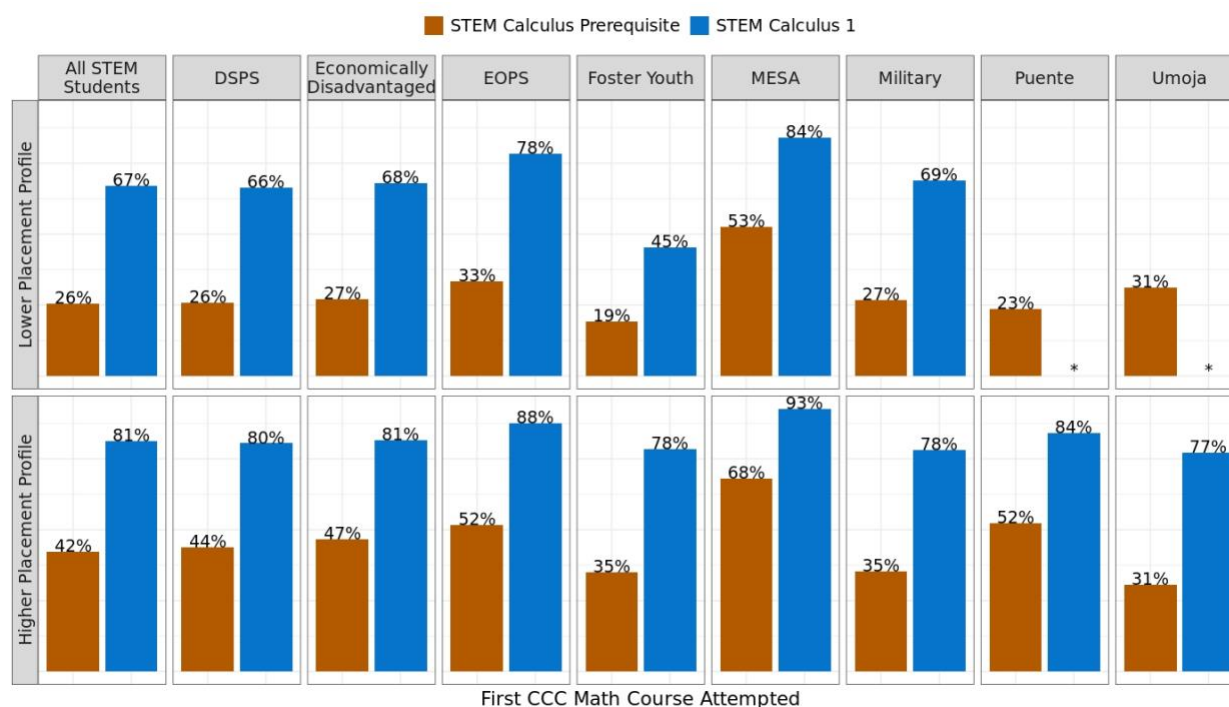


Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020 tracked for two years, excluding students whose first math enrollment was in summer. See Table 2 in Appendix B for cohort counts.

Figure 1 supports the findings in the main report for the full STEM cohort (also summarized in Figure 1 for All STEM Students). Special population status did not disrupt familiar trends in calculus completion based on first math course attempted. For every special population, the path to calculus had a predictable pattern of attrition based on the starting point in the path, and students who began directly in calculus were more likely to complete it.

When disaggregating by placement profile, special population students who started in STEM Calculus 1 were more likely to complete calculus in two years than students who started in a preparatory course, regardless of placement profile (Figure 2). We also observed the same pattern for the entire STEM cohort, represented as “All STEM Students” in the figure.

Figure 2. STEM Calculus 1 Two-Year Throughput for Special Populations by Placement Profile and Level of First CCC Math Course Attempted



Cohort: STEM students with initial math enrollment in 2012-2013 and 2019-2020 tracked for two years, excluding students whose first math enrollment was in summer. See Table 3 in the Appendix B for cohort counts.

Higher placement profile: HSGPA of 2.6 or greater and a C or better in high school Precalculus or Trigonometry.

Lower placement profile: one or both of the following: (1) HSGPA less than 2.6 and/or (2) did not take or pass high school Precalculus or Trigonometry.

Notes: Figure 2 combines students who started in any of the preparatory courses into one. Throughput rates are suppressed for groups where there were fewer than 10 students in the starting cohort, as indicated by an asterisk. Students in more than one special population group were counted in the throughput rates for each relevant group. For example, a foster youth student participating in EOPS was included in the calculations for both groups.

As expected, for students starting at the same course level, those with the lower placement profile had lower calculus completion than students with the higher placement profile across all special populations for which there was sufficient data. However, for every special population, the hindering effect of a preparatory start is starkly underscored by comparing students in the higher placement group who started in a preparatory course to students in the lower placement group who started in STEM Calculus 1. For instance, 52% of EOPS

students with a higher placement profile who began in a preparatory course completed calculus in two years, compared to 78% for EOPS students with a lower placement profile who began in STEM Calculus 1. In other words, students with a lower placement profile who started in STEM Calculus 1 outperformed students with a higher placement profile who started in preparatory courses within every special population.

Conclusion

In California's community colleges, the calculus completion outcomes for STEM students with special population status follow trends observed in the entire STEM cohort. Throughput patterns are predictable based on the first college math course attempted across placement profiles within each special population examined. Regardless of special population status or placement profile, students enrolling directly in STEM Calculus 1 as their first California community college math course had higher rates of calculus completion in two years than students starting in preparatory coursework. We have observed the same hindering effect of preparatory coursework on calculus completion across every disaggregation of STEM students we have examined to date.

These data suggest that providing direct access to STEM Calculus 1 with concurrent, targeted Precalculus support holds promise as a strategy for ameliorating attrition in the STEM calculus pathway and supporting more STEM students with special population status to complete the calculus requirements for their programs.

Appendix A. Special Populations Descriptions

Disabled Students Programs and Services (DSPS) provides support services, such as disability accommodations and specialized counseling and tutoring, to students with a wide range of physical, learning, and psychological disabilities.

Economically Disadvantaged status includes students who receive financial assistance through CalWORKs, Temporary Assistance for Needy Families (TANF), Aid to Families with Dependent Children (AFDC), or social security income; have an income below the poverty line; are homeless; or have other circumstances eligible under the guidelines provided in the “California State Plan for Career Technical Education.”

Extended Opportunity Programs and Services (EOPS) offers additional academic and support counseling, financial aid, and other services to students disadvantaged by social, economic, educational, or linguistic barriers.

Foster Youth status includes students who are now, or ever have been, in a court-ordered placement out of the home, such as foster care, a group home, or a court-ordered placement with a relative.

Mathematics, Engineering, and Science Achievement (MESA) serves financially and educationally disadvantaged students who are pursuing STEM majors; it offers a variety of services, including specialized academic counseling, peer cohort development, workshops and tutoring in a STEM Center, and transfer connections with California State University and University of California STEM support programs for underrepresented students.

Military status relates to students with United States (US) military service, including active duty, veterans, Active Reserve, and National Guard.

Puente provides a cohort-based experience in English and/or math primarily for Latinx students who are educationally disadvantaged, along with educational counseling and mentoring services.

Umoja is a student success program primarily for African American students that includes educational counseling, workshops, cultural events, mentoring, and personal development.

Appendix B. Data Tables

Table 1. Distribution of STEM Students by Special Population Status

Special Population Group	n	%
DSPS	1,838	5%
Economically Disadvantaged	3,562	10%
EOPS	4,113	11%
Foster Youth	562	2%
MESA	1,381	4%
Military	720	2%
Puente	224	Less than 1%
Umoja	182	Less than 1%
All STEM students, including those not in special population groups	37,232	

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer. Students in more than one special population group were included in counts for each relevant group. For example, a student participating in EOPS and in Puente was included in the count for both groups.

Table 2. STEM Calculus 1 Two-Year Throughput Rate (TR%) by Special Population Status and First CCC Math Course Attempted (n = cohort count)

First CCC Math Course	Special Population Group																	
	All STEM Students		DSPS		Econ Disadv		EOPS		Foster Youth		MESA		Military		Puente		Umoja	
	n	TR%	n	TR%	n	TR%	n	TR%	n	TR%	n	TR%	n	TR%	n	TR%	n	TR%
College Algebra	5,428	18%	294	17%	412	19%	598	25%	115	15%	96	48%	121	17%	23	22%	36	14%
Trigonometry	9,489	29%	497	26%	869	31%	1,101	36%	151	24%	326	54%	209	32%	81	30%	50	36%
Precalculus	10,667	42%	549	46%	1,129	42%	1,222	51%	161	33%	405	67%	206	35%	61	48%	56	38%
STEM Calculus 1	11,648	78%	498	77%	1,152	78%	1,192	86%	135	68%	554	91%	184	75%	59	80%	40	73%
Total	37,232	47%	1,838	44%	3,562	49%	4,113	53%	562	35%	1,381	72%	720	41%	224	47%	182	40%

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer. Students in more than one special population group were included in counts for each relevant group.

Table 3. STEM Calculus 1 Two-Year Throughput Rate (TR%) by Special Population Status, Level of First CCC Math Course Attempted, and Placement Profile

Special Population Group	Started in STEM Calculus Prerequisite						Started in STEM Calculus 1					
	Lower Placement Profile			Higher Placement Profile			Lower Placement Profile			Higher Placement Profile		
	Completed	Cohort	TR%	Completed	Cohort	TR%	Completed	Cohort	TR%	Completed	Cohort	TR%
DSPS	224	873	26%	205	467	44%	93	140	66%	288	358	80%
Economically Disadvantaged	410	1,523	27%	414	887	47%	174	256	68%	730	896	82%
EOPS	616	1,851	33%	553	1,070	52%	202	258	78%	818	934	88%
Foster Youth	53	275	19%	53	152	35%	19	42	45%	73	93	79%
MESA	236	449	53%	257	378	68%	89	106	84%	415	448	93%
Military	98	366	27%	60	170	35%	42	61	69%	96	123	78%
Puente	23	98	24%	35	67	52%	*	*	*	42	50	84%
Umoja	29	93	31%	15	49	31%	*	*	*	27	35	77%
All STEM Students	3,971	15,487	26%	4,272	10,097	42%	1,662	2,485	67%	7,438	9,163	81%

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer.

Higher placement profile: HSGPA of 2.6 or greater and a C or better in high school Precalculus or Trigonometry.

Lower placement profile: One or both of the following: (1) HSGPA less than 2.6 and/or (2) did not take or pass high school Precalculus or Trigonometry.

Students in more than one special population group were included in counts for each relevant group.

Throughput rates are suppressed for groups where there were fewer than 10 students in the starting cohort, as indicated by an asterisk.